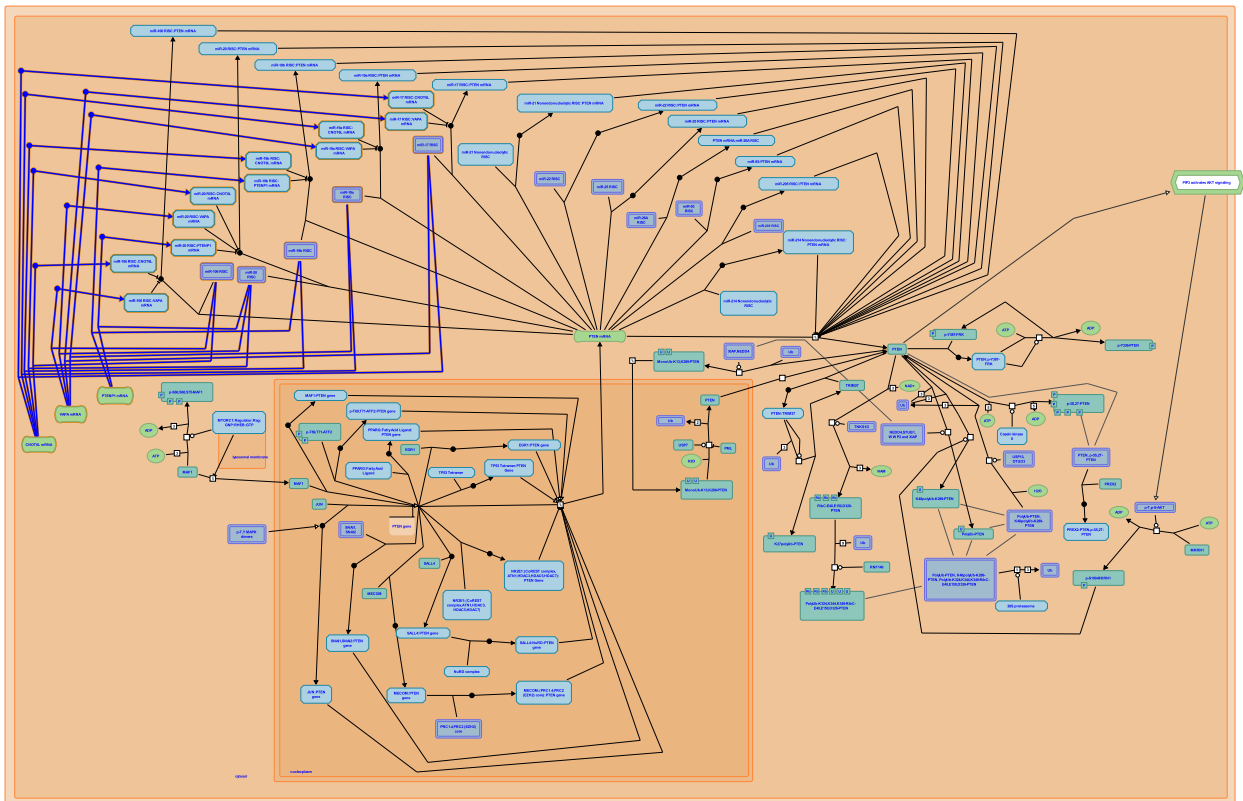


# Competing endogenous RNAs (ceRNAs)

## regulate PTEN translation



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This is just an excerpt of a full-length report for this pathway. To access the complete report, please download it at the [Reactome Textbook](https://reactome.org/textbook/).

03/05/2024

## Introduction

Reactome is open-source, open access, manually curated and peer-reviewed pathway database. Pathway annotations are authored by expert biologists, in collaboration with Reactome editorial staff and cross-referenced to many bioinformatics databases. A system of evidence tracking ensures that all assertions are backed up by the primary literature. Reactome is used by clinicians, geneticists, genomics researchers, and molecular biologists to interpret the results of high-throughput experimental studies, by bioinformaticians seeking to develop novel algorithms for mining knowledge from genomic studies, and by systems biologists building predictive models of normal and disease variant pathways.

The development of Reactome is supported by grants from the US National Institutes of Health (P41 HG003751), University of Toronto (CFREF Medicine by Design), European Union (EU STRP, EMI-CD), and the European Molecular Biology Laboratory (EBI Industry program).

## Literature references

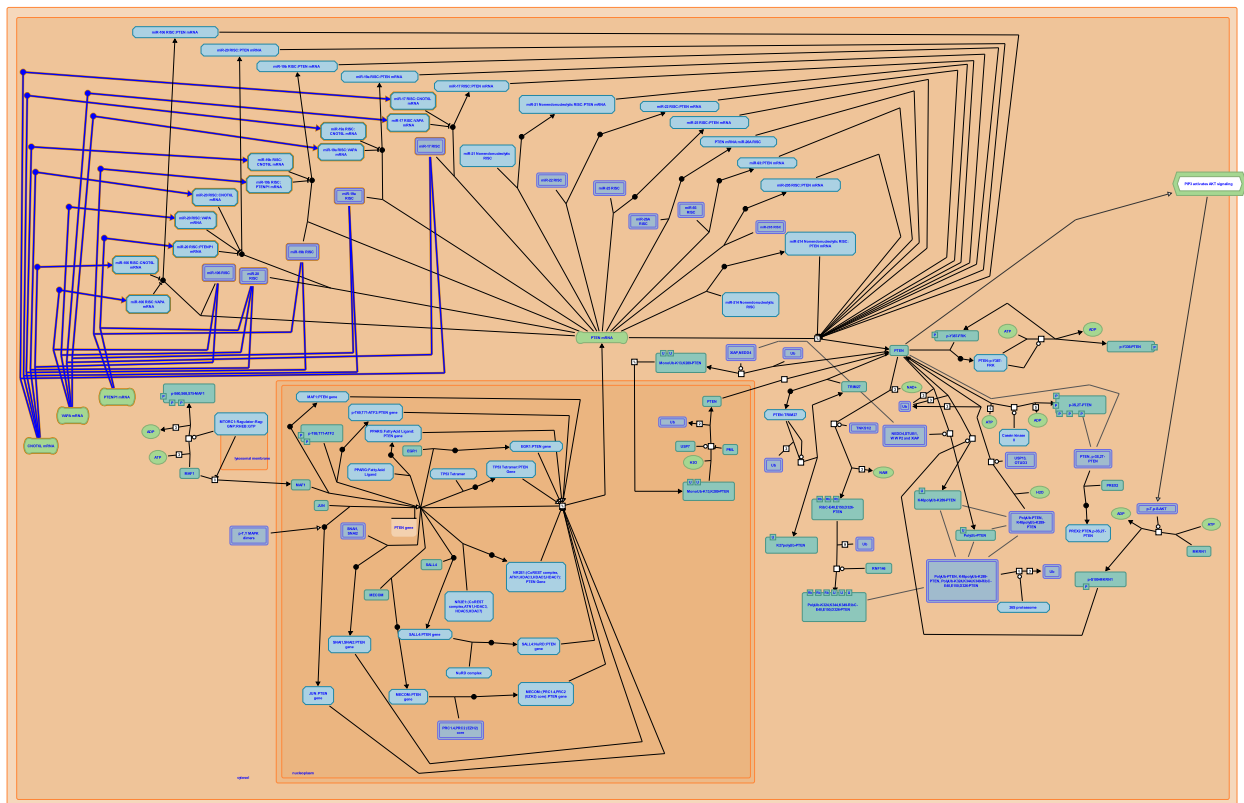
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- Fabregat, A., Jupe, S., Matthews, L., Sidiropoulos, K., Gillespie, M., Garapati, P. et al. (2018). The Reactome Pathway Knowledgebase. *Nucleic Acids Res*, 46, D649-D655. [↗](#)
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Reactome database release: 88

This document contains 1 pathway and 11 reactions ([see Table of Contents](#))

# Competing endogenous RNAs (ceRNAs) regulate PTEN translation ↗

Stable identifier: R-HSA-8948700



reactome

Coding and non-coding RNAs can prevent microRNAs from binding to PTEN mRNA. These RNAs are termed competing endogenous RNAs or ceRNAs. Transcripts of the pseudogene PTENP1 and mRNAs transcribed from SERINC1, VAPA and CNOT6L genes exhibit this activity (Poliseno et al. 2010, Tay et al. 2011, Tay et al. 2014). SERINC1 mRNA will be annotated in this context when additional experimental details become available.

## Literature references

- Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗
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- Pandolfi, PP., Carver, B., Haveman, WJ., Poliseno, L., Zhang, J., Salmena, L. (2010). A coding-independent function of gene and pseudogene mRNAs regulates tumour biology. *Nature*, 465, 1033-8. ↗

## Editions

2016-08-11	Authored	Carracedo, A., Salmena, L.
2016-11-03	Authored	Orlic-Milacic, M.
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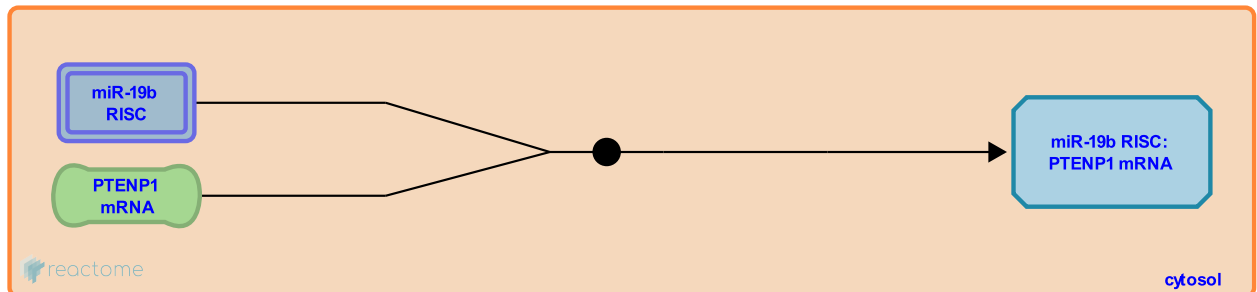
## PTENP1 mRNA binds miR-19b RISC ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948524

**Type:** binding

**Compartments:** cytosol



PTENP1 mRNA is the product of the PTEN pseudogene PTENP1 and is highly homologous to PTEN mRNA. PTENP1 mRNA contains a perfect match for the miR-19 family of microRNAs, which target PTEN mRNA for degradation. miR-19b was shown to suppress both PTENP1 and PTEN transcript levels.

Overexpression of PTENP1 3'UTR results in de-repression of both PTEN mRNA and protein in the presence of mature PTEN-targeting microRNAs. Knockdown of PTENP1 decreases abundance of PTEN mRNA and protein. PTENP1 therefore functions as a competing endogenous RNA (ce-RNA) in microRNA-mediated PTEN regulation. PTENP1 losses have been reported in cancer (Poliseno et al. 2010).

### Literature references

Pandolfi, PP., Carver, B., Haveman, WJ., Poliseno, L., Zhang, J., Salmena, L. (2010). A coding-independent function of gene and pseudogene mRNAs regulates tumour biology. *Nature*, 465, 1033-8. ↗

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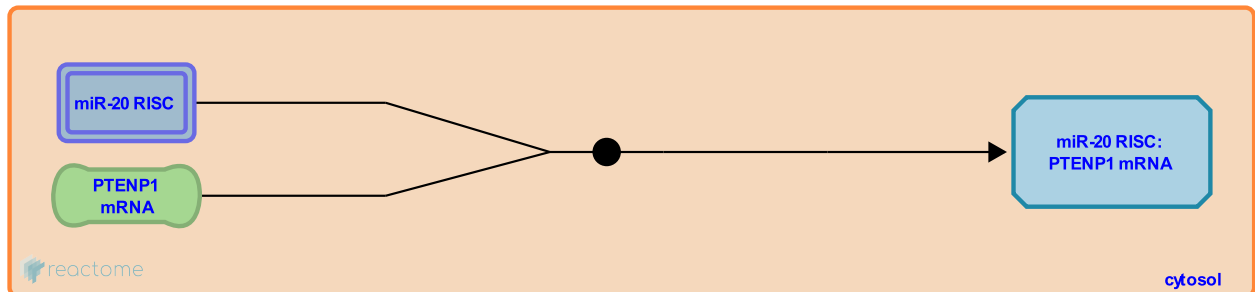
## PTENP1 mRNA binds miR-20 RISC ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948536

**Type:** binding

**Compartments:** cytosol



PTENP1 mRNA is the product of the PTEN pseudogene PTENP1 and is highly homologous to PTEN mRNA. PTENP1 mRNA contains a perfect match for the miR-20 family of microRNAs, which target PTEN mRNA for degradation. miR-20a was shown to suppress both PTENP1 and PTEN transcript levels, and it is possible that miR-20b functions in a similar manner.

Overexpression of PTENP1 3'UTR results in de-repression of both PTEN mRNA and protein in the presence of mature PTEN-targeting microRNAs. Knockdown of PTENP1 decreases abundance of PTEN mRNA and protein. PTENP1 therefore functions as a competing endogenous RNA (ce-RNA) in microRNA-mediated PTEN regulation. PTENP1 losses have been reported in cancer (Poliseno et al. 2010).

### Literature references

Pandolfi, PP., Carver, B., Haveman, WJ., Poliseno, L., Zhang, J., Salmena, L. (2010). A coding-independent function of gene and pseudogene mRNAs regulates tumour biology. *Nature*, 465, 1033-8. ↗

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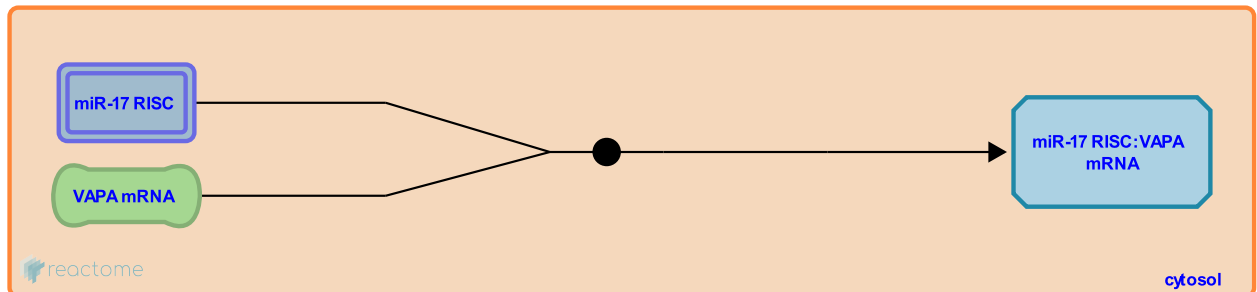
## miR-17 microRNA binds VAPA mRNA ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948582

**Type:** binding

**Compartments:** cytosol



MicroRNA miR-17 binds the VAPA mRNA. VAPA mRNA acts as a competing endogenous RNA (ceRNA) for PTEN, preventing binding of miR-17 microRNA to PTEN mRNA and PTEN downregulation (Tay et al. 2011).

### Literature references

Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗

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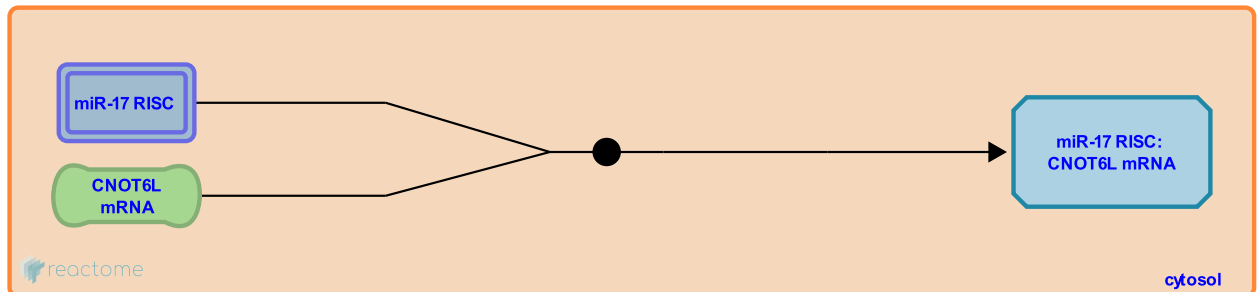
## miR-17 microRNA binds CNOT6L mRNA ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948583

**Type:** binding

**Compartments:** cytosol



MicroRNA miR-17 binds the CNOT6L mRNA. CNOT6L mRNA acts as a competing endogenous RNA (ceRNA) for PTEN, preventing binding of miR-17 microRNA to PTEN mRNA and PTEN downregulation (Tay et al. 2011).

### Literature references

Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗

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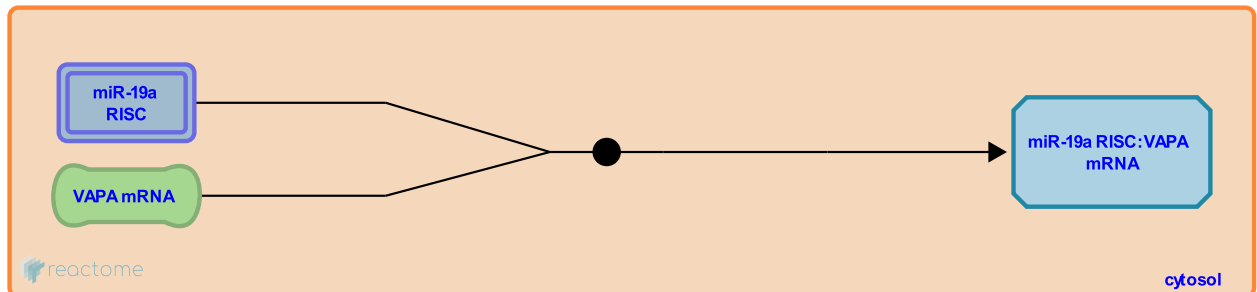
## miR-19a microRNA binds VAPA mRNA ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948594

**Type:** binding

**Compartments:** cytosol



MicroRNA miR-19a binds the VAPA mRNA. VAPA mRNA acts as a competing endogenous RNA (ceRNA) for PTEN, preventing binding of miR-19a microRNA to PTEN mRNA and PTEN downregulation (Tay et al. 2011).

### Literature references

Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗

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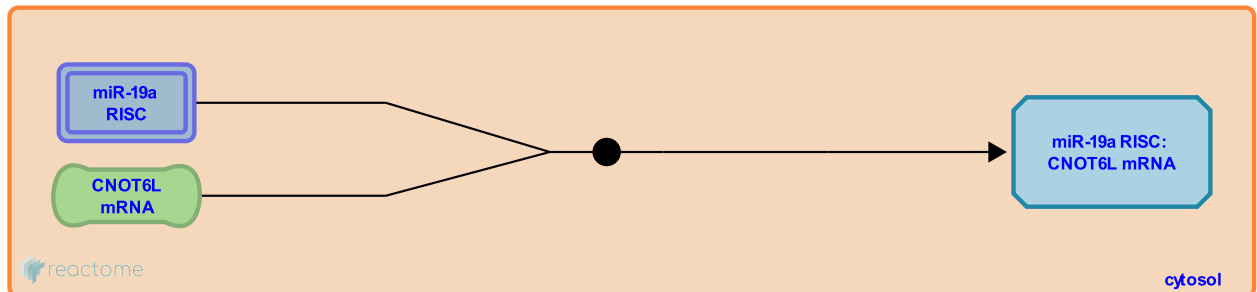
## miR-19a microRNA binds CNOT6L mRNA ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948602

**Type:** binding

**Compartments:** cytosol



MicroRNA miR-19a binds the CNOT6L mRNA. CNOT6L mRNA acts as a competing endogenous RNA (ceRNA) for PTEN, preventing binding of miR-19a microRNA to PTEN mRNA and PTEN downregulation (Tay et al. 2011).

### Literature references

Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗

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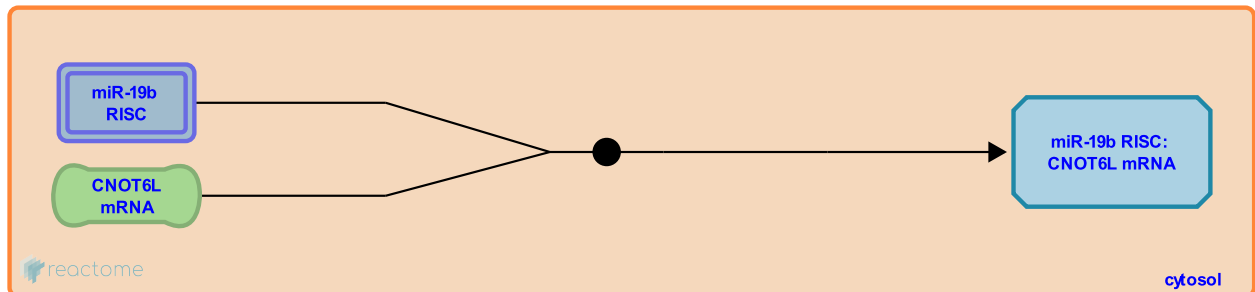
## miR-19b microRNA binds CNOT6L mRNA ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948612

**Type:** binding

**Compartments:** cytosol



MicroRNA miR-19b, encoded by the MIR19B1 and MIR19B2 genes, binds the CNOT6L mRNA. CNOT6L mRNA acts as a competing endogenous RNA (ceRNA) for PTEN, preventing binding of miR-19b microRNA to PTEN mRNA and PTEN downregulation (Tay et al. 2011).

### Literature references

Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗

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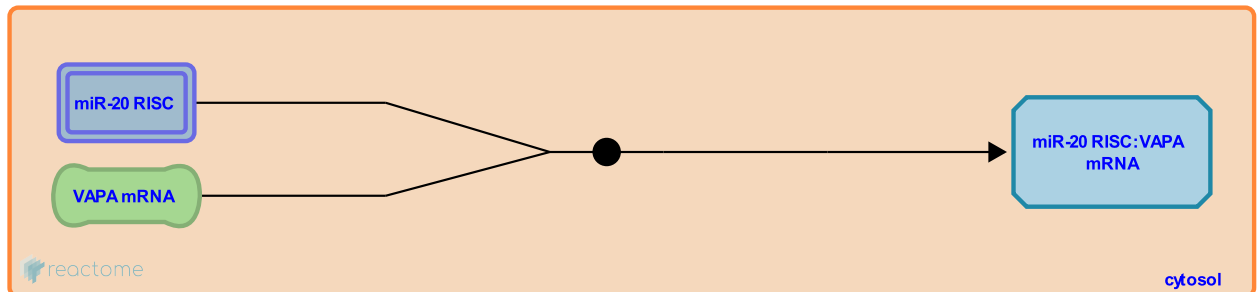
## miR-20 microRNAs bind VAPA mRNA ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948621

**Type:** binding

**Compartments:** cytosol



MicroRNAs miR-20a and miR-20b bind the VAPA mRNA. VAPA mRNA acts as a competing endogenous RNA (ceRNA) for PTEN, preventing binding of miR-20 microRNAs to PTEN mRNA and PTEN downregulation (Tay et al. 2011).

### Literature references

Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗

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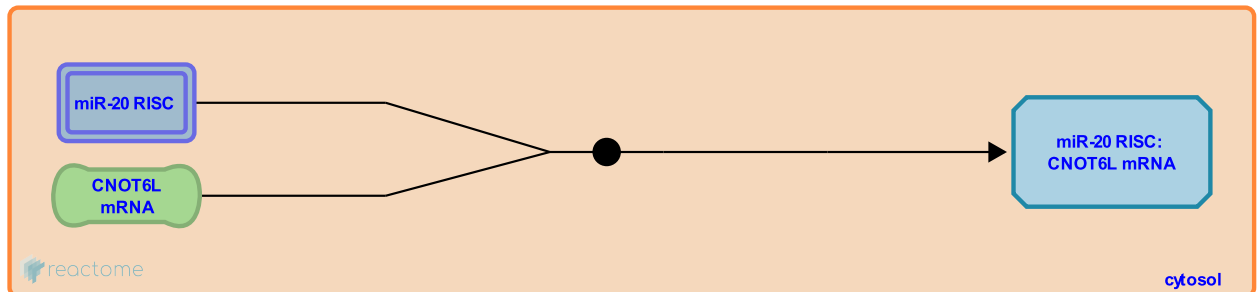
## miR-20 microRNAs bind CNOT6L mRNA ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948623

**Type:** binding

**Compartments:** cytosol



MicroRNAs miR-20a and miR-20b bind the CNOT6L mRNA. CNOT6L mRNA acts as a competing endogenous RNA (ceRNA) for PTEN, preventing binding of miR-20 microRNAs to PTEN mRNA and PTEN downregulation (Tay et al. 2011).

### Literature references

Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗

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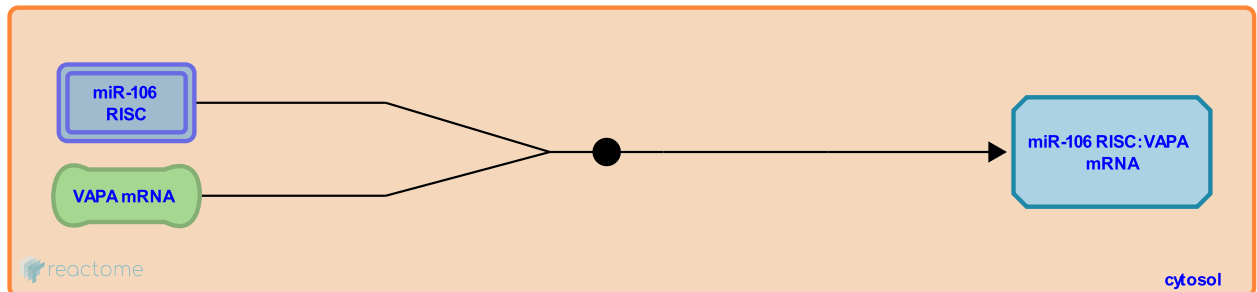
## miR-106 microRNAs bind VAPA mRNA ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948641

**Type:** binding

**Compartments:** cytosol



MicroRNAs miR-106a and miR-106b bind the VAPA mRNA. VAPA mRNA acts as a competing endogenous RNA (ceRNA) for PTEN, preventing binding of miR-106 microRNAs to PTEN mRNA and PTEN downregulation (Tay et al. 2011).

### Literature references

Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗

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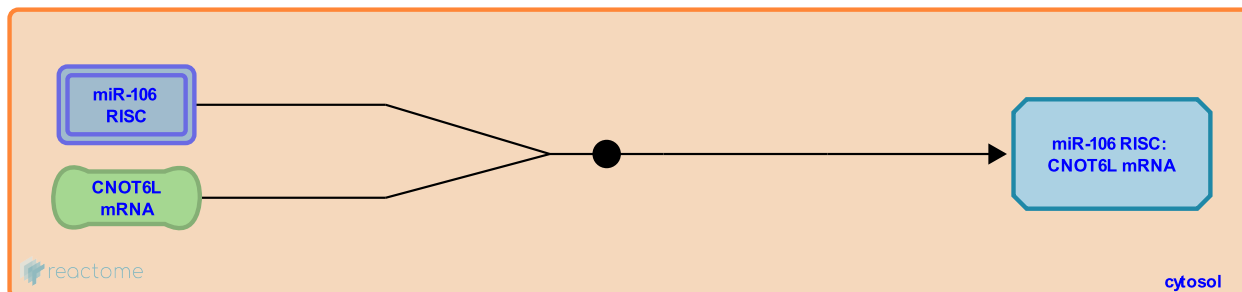
## miR-106a,(miR106b) microRNA binds CNOT6L mRNA ↗

**Location:** [Competing endogenous RNAs \(ceRNAs\) regulate PTEN translation](#)

**Stable identifier:** R-HSA-8948651

**Type:** binding

**Compartments:** cytosol



MicroRNA miR-106a (possibly also miR-106b) binds the CNOT5L mRNA. CNOT6L mRNA acts as a competing endogenous RNA (ceRNA) for PTEN, preventing binding of miR-106a microRNA to PTEN mRNA and PTEN downregulation (Tay et al. 2011).

### Literature references

Weiss, D., Karreth, F., Tan, SM., Di Cunto, F., Rigoutsos, I., Provero, P. et al. (2011). Coding-independent regulation of the tumor suppressor PTEN by competing endogenous mRNAs. *Cell*, 147, 344-57. ↗

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